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Social Cognition Training for Individuals with Schizophrenia: Emerging Evidence

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Growing evidence indicates that social cognitive deficits are important, unique determinants of poor functional outcome in schizophrenia. These findings have generated considerable interest in the possibility of intervening at the level of social cognition as a means of improving functional outcome. In this review article, we first briefly describe the major domains of social cognition that have been studied in schizophrenia and their functional relevance for people with this disorder. We then review and critically evaluate recent studies that examined the modifiability of social cognition in schizophrenia through psychosocial interventions, including brief experimental manipulations, longer-term studies that embed social cognitive training in broad, multi-component treatment packages, and longer-term treatment studies that specifically target social cognitive skills. Emerging evidence indicates that performance on social cognitive tasks is amenable to commonly used intervention techniques and that broad and targeted treatments can lead to improvements

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across multiple domains of social cognition. We conclude by discussing remaining challenges for this promising line of research.

Schizophrenia is characterized by severe impairment across multiple domains of functional outcome (Marder & Fenton, 2004). Dysfunction in the social domain is particularly debilitating and has far-reaching consequences, contributing to fractured family relationships, conflict with peers and coworkers, and social isolation. Social impairment is also among the most treatment refractory aspects of schizophrenia. It has become clear that further improvements in social functioning will not occur through gains in psychotic symptom management alone because psychotic symptoms are typically not closely related to functional adaptation levels in community-dwelling outpatients (Carter, 2006; Heydebrand, Weiser, Rabinowitz, Hoff, DeLisi, Csernansky et al., 2004). Instead, treatments that directly address the key determinants of poor social functioning are required to ameliorate these impairments.

There has been good success in identifying basic neurocognitive processes that predict social dysfunction. Scores of studies demonstrate broad compromise of neurocognitive functions in schizophrenia, including speed of processing, attention/vigilance, working memory, verbal learning and memory, visual learning and memory, reasoning and problem solving, and verbal comprehension. A large body of literature also supports both prospective and cross-sectional associations between neurocognitive and functional impairments in persons with schizophrenia (Green, Kern, Braff, & Mintz, 2000; Green, Kern, & Heaton, 2004). The presence of cognitive linkages to functional outcome provides a compelling rationale for intervening at the level of basic neurocognition as a means of improving functional outcome. This evidence has led to major NIMH initiatives (Measurement and Treatment Research to Improve Cognition in Schizophrenia [MATRICS], Treatment Units for Research on Neurocognition in Schizophrenia [TURNS]) to stimulate and guide the development of new pharmacological treatments for cognitive deficits that impact outcome (see Horan, Rassovsky, & Green, 2005).

Despite these efforts to enhance drug treatment development, it is unlikely that interventions targeting only basic neurocognition will be sufficient for schizophrenia patients to achieve optimal social functioning. Although research strongly supports a significant

relationship between neurocognition and functional outcome, the amount of variance in outcome that is accounted for is typically modest, ranging from about 20% to 40% for composite indices across multiple neurocognitive domains. Thus, anywhere from 60% to 80% of the variance in functional outcome is typically unaccounted for by traditional neurocognitive measures (Penn, Addington, & Pinkham, 2006). These findings indicate a critical need to identify and treat other determinants of poor outcome.

In addition, there has until recently been a substantial gap in our understanding of the mechanisms, through which basic neurocognitive deficits are related to actual functioning in the community. Our group and others have theorized that there are a number of important intervening variables in the causal pathway(s) through which neurocognitive deficits ultimately impact social functioning (Green et al., 2000; Green & Nuechterlein, 1999; Penn, Corrigan, Bentall, Racenstein, & Newman, 1997; Vauth, Rusch, Wirtz, & Corrigan, 2004). From a treatment perspective, interventions that target variables that are more proximal in the chain of causal events that lead to poor functioning may help generalize treatment gains. Indeed, the treatment effects of traditional neurocognitive remediation interventions show very limited generalizability to functional improvements (but see McGurk, Mueser, Feldman, Wolfe, & Pascaris, 2007; Velligan, Kern, & Gold, 2006; Wexler & Bell, 2005 for recent exceptions). Thus, new treatments that equip patients with the skills that are central to navigating the complexities of social interactions are critical for improving outcome.

A rapidly growing body of research indicates that impairments in the domain of social cognition are important, unique determinants of functional outcome in schizophrenia (Couture, Penn, & Roberts, 2006). Furthermore, recent studies suggest that social cognition may be a mediating variable through which neurocognition impacts functional outcome. These developments have led a number of research groups throughout the world to examine whether social cognitive deficits are modifiable through brief experimental manipulations or more intensive psychosocial interventions. This article provides an overview and critical analysis of these recent developments. We first briefly describe the concept of social cognition, the types of social cognitive deficits found in schizophrenia patients, and evidence that these deficits are uniquely associated with community functioning. We then review studies (published in English) that have evaluated the modifiability

of social cognitive impairments in schizophrenia, including brief experimental manipulations, studies that embed social cognitive training in comprehensive treatment packages, and longer-term treatment studies that specifically target social cognition. We conclude with an assessment of the current state of psychosocial treatments for social cognitive deficits in schizophrenia and discuss remaining challenges for this line of research.

SOCIAL COGNITION IN SCHIZOPHRENIA

Social cognition refers to the mental operations underlying social interactions, which include processes involved in perceiving, interpreting, and generating responses to the intentions, dispositions, and behaviors of others (Brothers, 1990; Fiske & Taylor, 1991; Kunda, 1999). It has been defined as “the ability to construct representations of the relations between oneself and others, and to use those representations flexibly to guide social behavior” (Adolphs, 2001). Simply put, social cognition is a set of skills that people use to understand and effectively interact with other people. Theoretically, social cognitive skills are regarded as evolved capacities that are critical for social communication and interpersonal functioning (Burns, 2006; Dunbar, 1998; Premack & Woodruff, 1978). As such, problems in social cognition, such as misperceptions and unexpected reactions to and from other people, can be expected to impact peer, romantic, and family relationships as well as work and school behavior. Contemporary social cognition research encompasses a wide range of processes that may be important for understanding schizophrenia, spanning from basic biological motion perception to complex attitudinal and neuroeconomic processes (Lieberman, 2007). Schizophrenia researchers have thus far focused on only a subset of them.

Domains of Social Cognitive Impairments in Schizophrenia

While research on social cognition in schizophrenia is not particularly new (see Corrigan & Penn, 2001; Penn et al., 1997), there has been a steady escalation of research interest in this topic over the past five to ten years. It has become clear that schizophrenia patients show substantial deficits in several aspects of social

cognition. There have been two distinct goals of social cognitive research in schizophrenia: One line of research is devoted to understanding the nature of specific clinical symptoms (e.g., how aspects of social cognition relate to paranoia or thought control), and is pursued primarily in the United Kingdom. Another line of research, primarily in North America, has been devoted to social cognition's role in outcome. Schizophrenia researchers have focused primarily on the areas of *Emotional processing*, *Social perception*, *Theory of Mind*, and *Attributional style*.

Emotional processing refers broadly to aspects of perceiving and using emotion. One influential model of emotional processing, developed by Salovey and colleagues, defines emotional intelligence as a set of skills that combines emotions and cognition (Salovey & Sluyter, 1997; Mayer, Salovey, Caruso, & Sitarenios, 2001). The model is comprised of four emotional processing components, including identifying emotions, facilitating emotions, understanding emotions, and managing emotions (Mayer et al., 2001; Salovey & Sluyter, 1997). Emotion perception, which falls in the identifying emotions component of this model, has been the most extensively studied social cognitive process in schizophrenia. Emotion perception refers to the ability to infer emotional information from facial expressions, vocal inflections, or the combination, and is typically assessed by presenting static pictures of faces of a single person (e.g., the Facial Emotion Identification and Discrimination tasks; Kerr & Neale, 1993) or recordings of voices expressing prototypical emotions (e.g., happy, sad, angry, afraid, surprised, disgusted, ashamed). Impairment in emotion perception has been extensively documented in schizophrenia (Edwards, Jackson, & Pattison, 2002; Horan & Blanchard, 2003; Kee, Horan, Wynn, Mintz, & Green, 2006; Kohler & Martin, 2006).

Social perception refers to a person's ability to judge social cues from contextual information and communicative gestures, including awareness of the roles, rules, and goals that typically characterize social situations and guide social interactions (Corrigan & Green, 1993a; Corrigan, Wallace, & Green, 1992). Social perception involves identification of interpersonal features of a situation such as intimacy, status, mood state, and veracity, or making use of knowledge about what is typical in specific social situations. Hence, social perception can also refer to one's perception of relationships between people, in addition to perception of cues that are generated by a single person (Fiske, 1992). Schizophrenia patients have

repeatedly shown deficits on performance measures of social perception that involve making judgments about brief videotaped vignettes (e.g., the Profile of Nonverbal Sensitivity; Rosenthal, Hall, DiMatteo, Rogers, & Archer, 1979) or paper-and-pencil measures that assess knowledge of the characteristics of social situations, (e.g., the Situational Feature Recognition Test; Corrigan & Green 1993b).

Theory of Mind is also sometimes referred to as mental state attribution, mentalizing, or social intelligence. Theory of Mind typically refers to the ability to understand that others have mental states that differ from one's own and the capacity to make correct inferences about the content of those mental states. Processes typically associated with Theory of Mind involve the ability to understand false beliefs, hints, intentions, humor, deceptions, metaphor, and irony. The measures of Theory of Mind used in schizophrenia research are often modified versions of tasks used in developmental studies of children. For example, the classic "Sally and Ann" task employs short stories to assess whether individuals are capable of understanding basic first-order false beliefs (i.e., that someone can hold a false belief about a state of the world) or more complex second-order false beliefs (i.e., that someone can have a false belief about the belief of another person). Other paradigms evaluate whether subjects can arrange cartoon panels in a coherent fashion by using knowledge about the mental states of the characters depicted in the pictures (Frith & Corcoran, 1996). However, some newer measures have been specifically developed for adults. One example is The Awareness of Social Inferences Test (McDonald, Flanagan, & Rollins, 2002), which assesses mentalizing processes depicted in videotaped interactions between adults, such as forming inferences about others' intentions and beliefs, and detecting sarcasm and white lies. Schizophrenia patients have repeatedly shown deficits on a variety of tasks believed to involve Theory of Mind-related abilities (Brüne, 2005; Corcoran, 2001).

Attributional style refers to how individuals characteristically explain the causes for positive and negative events in their lives. In schizophrenia research, this aspect of social cognition has primarily been studied in the context of understanding the psychological mechanisms of persecutory delusions and paranoid beliefs. For example, research indicates that individuals with persecutory delusions tend to blame others rather than situations for negative events, an attributional style known as a "personalizing bias" (Bentall, Corcoran, Howard, Blackwood, & Kinderman, 2001;

Garety & Freeman, 1999). Individuals characterized by this style may also be prone to attribute ambiguous events to hostile intentions of others or to jump quickly to conclusions when forming impressions about others without modifying their impressions based on contextual information. Instrumentation in this area is somewhat limited, though associations between paranoid beliefs and attributional style have been found using socioemotional information processing tasks and a self-report measure that describes various situations and asks participants to generate an explanation for why the events occurred (Internal, Personal, and Situational Attributions Questionnaire; Bentall et al., 2001; Kinderman & Bentall, 1996).

It has become clear that many schizophrenia patients show substantial impairments in emotional processing, social perception, Theory of Mind, and certain biases in attributional style. Research in this area has been conducted primarily with chronically ill patients. However, several studies have reported social cognitive impairments in unmedicated or recent-onset patients (Edwards, Pattison, Jackson, & Wales, 2001; Herbener, Hill, Marvin, Sweeney, 2005; Pinkham, Penn, Perkins, Graham, & Siegel, 2007; Wölwer, Streit, Polzer, & Gaebel, 1996). In addition, social cognitive impairments have been found in some studies of unaffected relatives of schizophrenia patients (Farzin, Platek, Panyavin, Calkins, Kohler, Siegel, Schacter, Gur, 2006; Gur, Gur, Calkins, Horan, Nuechterlein, Seidman, Stone, 2007; Kee, Horan, Mintz, & Green, 2004). Thus, deficits in social cognition appear to be present across different stages of schizophrenia and may also characterize individuals at heightened risk for the development of this disorder.

Social Cognitive Impairments as Treatment Targets

In addition to theoretical linkages between social cognitive processes and adaptive social functioning, three lines of research have led to enthusiasm about the possibility of developing treatments that target social cognition as a means of improving social functioning. First, growing evidence indicates that performance deficits on tasks that assess social cognition have functional significance in schizophrenia. In a recent comprehensive literature review of 23 studies, Couture and colleagues (2006) documented significant relationships between each of the four domains discussed above and aspects of functioning, including actual community functioning, quality of life, social behaviors in therapeutic settings, and performance measures of social

competence (e.g., social role-play tasks). The majority of relevant studies examined emotion perception and social perception. Theory of Mind and Attributional style have received considerably less attention in terms of their functional significance, though existing studies do support associations with social competence and community functioning.

Second, there is a general consensus that social cognition is distinct from, though related to, basic neurocognition and other clinical features of schizophrenia (Green, Olivier, Crawley, Penn, & Silverstein, 2005; Penn Corrigan, Bentall, Racenstein, Newman, 1997; Penn, Spaulding, Reed, & Sullivan, 1996). For example, correlations between performance measures of social cognition and basic neurocognition are generally small to moderate (Greig, Bryson, & Bell, 2004; Ihnen, Penn, Corrigan, & Martin, 1998; Kee, Kern, & Green, 1998; Pinkham & Penn, 2006; Sergi & Green, 2002). Social cognitive deficits also cannot be entirely explained by other aspects of the illness that are associated with poor functioning, such as negative symptoms (Sergi, Rassovsky, Widmark, Reist, Erhant, Braff, Marder, Green, 2007). In addition, dissociations between aspects of social cognition and basic nonsocial cognition are evident in various clinical conditions, such as prosopagnosia, Williams syndrome, and patients with certain prefrontal cortex lesions (Anderson, Bechara, Damasio, Tranel, & Damasio, 1999; Jones et al., 2000; Kanwisher, 2000). Functional neuroimaging research also increasingly suggests that the processing of social and nonsocial stimuli rely on semi-independent neural systems, with growing evidence of a neural network composed of the prefrontal cortex, fusiform gyrus, superior temporal sulcus, and amygdala that is specialized for processing social information (Brunet-Gouet & Decety, 2006; Pinkham, Penn, Perkins, & Lieberman, 2003).

Third, recent studies suggest that social cognition shows *unique* relationships to functional outcomes, above and beyond basic cognition. In theoretical models, our group has proposed that social cognition mediates relations between neurocognition and functional status in schizophrenia (Green et al., 2000; Green & Nuechterlein, 1999). Earlier support for social cognition's role as a mediator in schizophrenia was largely indirect, coming mainly from correlational studies supporting a link between basic cognition and social cognition, on the one hand (Addington & Addington, 1998; Bryson, Bell, & Lysaker, 1997; Kee et al., 1998; Sergi & Green, 2002), and between social cognition and functional

status in schizophrenia, on the other (Hooker & Park, 2002; Kee, Green, Mintz, & Brekke, 2003; Mueser, Doonan, Penn, Blanchard, Bellack, Nishith, DeLeor, 1996; Penn, Spaulding, Reed, Sullivan, 1996). However, direct support for a mediational role comes from a recent a series of statistical modeling studies using path analysis or structural equation modeling (Addington, Saeedi, & Addington, 2006; Brekke, Kay, Kee, & Green, 2005; Sergi, Rassovsky, Nuechterlein, & Green, 2006; Vauth, Rusch, Wirtz, & Corrigan, 2004). For example, a recent structural equation modeling study from our lab indicated that social perception fully mediated the relationship between indices of early visual processing and functional status in schizophrenia (Sergi et al., 2006). Hence, like basic cognition, social cognition is a determinant of functional outcome that appears to be a valuable target for intervention. In fact, social cognition appears to be more proximal to functional outcome than basic cognition and, for that reason, could be an even better target for intervention.

In summary, schizophrenia patients demonstrate reliable deficits on social cognitive tasks, performance on these tasks is uniquely associated with patients' level of functioning, and these deficits may help explain the mechanisms through which basic cognition impacts outcome. These findings have generated considerable excitement about the possibility of modifying social cognitive abilities as a means of resolving the functional disability associated with schizophrenia. As an indication of social cognition's increasing visibility, the investigators of the NIMH-MATRICES identified social cognition as one of seven key cognitive domains that should be routinely assessed in clinical trials of new cognition-enhancing drugs for schizophrenia (Nuechterlein, Barch, Gold, Goldberg, Green, & Heaton, 2004). The remainder of this review focuses on early efforts to examine the modifiability of social cognitive deficits in schizophrenia.

MODIFIABILITY OF SOCIAL COGNITIVE DEFICITS IN SCHIZOPHRENIA

A number of investigators have assessed the feasibility of modifying the performance of schizophrenia patients on social cognitive tasks. These studies have employed a variety of psychological techniques across widely varying durations. To organize this review, we divide these studies into three categories: brief "proof

of concept” studies, broad treatment studies, and targeted treatment studies.

Proof-of-Concept Studies

Proof-of-concept studies refer to studies that examined the modifiability of performance on a social cognitive test using relatively brief manipulations that typically involve one or two training sessions. This type of study parallels early research in the area of basic neurocognitive remediation, in which the goals were to remediate performance deficits on a specific neurocognitive test through a brief, simple manipulation (e.g., Hellman, Kern, Neilson, & Green, 1998; Kern, Green, & Goldstein, 1995). These studies are summarized in Table 1 in roughly chronological order.

Five of the identified studies targeted facial emotion perception. Four of these assessed performance on standard facial emotion identification and discrimination tasks that use still photos of posed facial expressions. One assessed performance on a specialized measure of “microexpressions,” which involves animated faces that quickly (15 ms) transition from a neutral expression to an emotional expression and then back to neutral. There is some variability across studies in the specific emotional expressions addressed, and the task formats used to assess them. The interventions typically lasted less than one hour and the interventions varied widely, including monetary reinforcement, facial mimicry, practice with commercially available computerized training exercises, and the use of attentional prompts to direct attention to relevant facial features. In each study, patients receiving the active interventions showed significant improvements in facial emotion perception. In addition, there is initial evidence of generalization to other emotion perception tasks (Combs, Tosheva, Wanner, & Basso, 2006; Penn & Combs, 2000) and of durability of improvements for up to one week (Combs et al., 2006).

A French research group examined the modifiability of Theory of Mind task performance in a pair of studies. They first examined whether performance on a Theory of Mind cartoon task was sensitive to the specific format in which the task was presented (Sarfati et al., 2000). Schizophrenia patients and healthy nonpatient controls both performed better when Theory of Mind test items were administered using a verbal as compared to a visual format, which was interpreted to suggest that the verbal format helped subjects

TABLE 1. Proof of concept studies

Reference and Country	Subjects and Treatment Target	Duration and Format	Treatment Description	Assessments	Results and Notes
Corrigan et al. (1995) United States	40 Schizophrenia and schizoaffective - mixed inpatients and outpatients 20 vigilance-only training condition 20 vigilance-plus-memory training condition Target: Social cue perception	Single 60-minute session Individual administration	Vigilance-training vs. Vigilance-plus-memory training on social cue perception task Training stimuli: eight videotaped vignettes from the Social Cue Recognition Test (Corrigan & Green, 1993a), 30-45 s each involving 2-3 actors engaged in low emotion or high emotion situations. After each vignette, participants answered 36 true-false questions. Vigilance training: self instruction to pay attention to videos, repeated practice Vigilance-plus-memory training: vigilance strategies plus guided semantic elaboration about feelings of the characters.	Posttraining and 48-hour follow-up Post-training assessment: Cue Recognition Test (Corrigan et al., 1992); eight videos depicting people involved in interpersonal problems—18 true-false items after each vignette Follow-up assessment: Social Cue Recognition Test and Cue Recognition Test	Vigilance-plus-memory training group had significantly higher Social Cue Recognition Test scores at posttest and follow-up. Vigilance-plus-memory training also had significantly higher Cue Recognition Tests at posttest and nearly ($p = .06$) at follow-up. Same measure (Social Cue Recognition Test) used in training and follow-up assessments

(Continued)

TABLE 1. Continued

Reference and Country	Subjects and Treatment Target	Duration and Format	Treatment Description	Assessments	Results and Notes
Penn & Combs (2000) United States	40 Schizophrenia and schizoaffective inpatients Target: Facial affect perception	Multiphase training session completed in one day Individual administration	Manipulation of training instructions for facial emotion identification task Subjects randomized to one of four training conditions for the Facial Emotion Identification Tests (Kerr & Neale, 1993): 1) Repeated practice 2) Monetary reinforcement 3) Facial mimicry 4) Combination of 2 and 3	Pre- & posttests, one-week follow-up Facial Emotion Identification Task and Facial Emotion Discrimination Task (Kerr & Neale, 1993)	All three active intervention conditions significantly improved Facial Emotion Identification Test. Effects were generally retained at one-week follow-up Some evidence of generalization to Facial Emotion Discrimination Test for monetary condition at posttest, but no generalization at one-wk follow-up Same test (Facial Emotion Identification Test) used in training and assessments

Sarfati et al. (2000)	25 Schizophrenia inpatients	Single session Individual administration	Modification of Theory of Mind test response format	Single assessment Character Intention Task: 14 items: response options presented in original picture format 14 items: response options presented in verbal format	Both groups performed significantly better on verbal than visual format
France	20 Healthy controls		28-item comic strip Character Intention Task (Sarfati et al., 1997). In original task, each item consists of a four-panel cartoon in which only the first three panels are presented. The subject's task is to select one of four pictures that complete the cartoon. The task was modified such that 14 items administered response choices in verbal format and 14 items administered response choices in standard picture format.	No group by format interactions Suggests differences in Theory of Mind task performance differences based on response format Ceiling effect in controls	

(Continued)

TABLE 1. Continued

Reference and Country	Subjects and Treatment Target	Duration and Format	Treatment Description	Assessments	Results and Notes
Silver et al. (2004) Israel	20 Schizophrenia inpatients Target: Emotion perception	Three 15-minute sessions spaced two to three days apart Individual administration	Emotion Trainer Software (Silver & Oakes, 2001) Exercises designed to improve: (1) Recognizing the core facial expressions; (2) anticipating the emotional response from events and situations; 3) working out whether a person will be pleased or disappointed according to what he or she wants; 4) anticipating the emotional response from thoughts and beliefs; 5) working out whether a person will be pleased or disappointed according to his or her likes and dislikes. All exercises can be completed in 15 min.	Pre- and posttests Identification of Facial Emotions (PEAT; Erwin et al., 1992); happy, sad, neutral faces Emotion Recognition 40 (ER40; Kohler et al., 2003); happy, sad, angry, fearful, neutral faces Differentiation of Facial Emotions (EmDiff; Kohler et al., 2000); judge similarity of intensity of happy or sad faces Neuropsychological tests of attention and working memory	Significant reduction in errors across training sessions Significant pre- to posttraining improvements on PEAT and ER40 No significant changes on EmDiff or neuropsychological tests Software developed for children with autism

Russell et al. (2006) United Kingdom/ Australia	21 schizophrenia outpatients 15 healthy controls Target: Perception of micro-expressions of facial emotions	One session Individual administration	Ekman's Micro Expression Training Tool (METT; Ekman, 2003) software program Initial training shows four pairs of commonly confused emotions in slow-motion video sequences (anger/disgust, contempt/happy, fear/surprise, fear/sadness). The important distinctions between the expressions are contrasted and explained. In the practice session (28 trials), participants label the microexpression (15 ms) with corrective feedback provided. Posttraining review uses alternate faces to display four pairs of commonly confused expressions.	Pre- and posttests Microexpression labeling task using 14 faces (happy, angry, sad, disgust, fear, surprise, contempt) 50-item Emotion Matching Test (happy, sad, angry, disgust, neutral) (Ekman & Friesen, 1976)	For both outcome measures, there were significant main effects for group and training, but no significant group X training interactions. Patients performed generally worse than controls, but showed comparable levels of improvement following training
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(Continued)

TABLE 1. Continued

Reference and Country	Subjects and Treatment Target	Duration and Format	Treatment Description	Assessments	Results and Notes
Kayser et al. (2006) France	14 Schizophrenia outpatients Seven: video treatment group Seven: medication treatment as usual Targets: Theory of Mind Communication disturbances	Two 60-minute sessions Individual administration	Guided discussion of mental states of people interacting in movie clips 12 short (20–70 s) scenes from recent movies showing interactions between two or more persons whose mental states need to be identified and analyzed (e.g., beliefs, disappointment, surprise, hostility, irony, and misunderstanding). Guided discussion of what the characters were feeling and intending, including generating hypotheses and evaluating arguments for them.	Pre- and posttests Nonverbal comic strip Theory of Mind task (Sarfati et al., 1997) Schizophrenia Communication Disorder Rating Scale (Olivier et al., 1997)	No main effects for group or treatment, and no group X treatment interactions. However, there were significant improvements within the video treatment group on the Theory of Mind task and the Communication Disorder Rating Scale, but no significant improvements in the control group. Raters not blind to group membership

<p>Combs et al. (2006) United States</p>	<p>22 Schizophrenia forensic inpatients 12: Attentional prompt condition Ten: Repeated practice Target: Facial emotion perception</p>	<p>Single session</p>	<p>Attentional prompt manipulation during facial emotion identification task Utilized attentional prompts to direct attention to the face as a means to improve emotion perception.</p>	<p>Pretest, posttest, and one-week follow-up assessments Facial Emotion Identification Test (FEIT; Kerr & Neale, 1993) Bell-Lysaker Emotion Recognition Test (BLERT; Bell et al., 1997) also administered at one-week follow-up assessment</p>	<p>Attention group superior on FEIT across all assessments, and also BLERT at one-week follow-up Same test used in training and assessment, though generalization to BLERT found as well.</p>
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extract relevant features of the characters' intentions from the cartoons. Kayser and colleagues (Kayser, Sarfati, Besche, & Hardy-Baylé, 2006) subsequently evaluated the benefit of two Theory of Mind training sessions that involved watching and analyzing film clips of social interactions (particularly the characters' intentions and emotions). Although there were no significant between-group effects of training for the very small experimental ($n = 8$) and control ($n = 6$) groups, the experimental group did show significant within-group improvement across training sessions.

Taken together, these proof-of-concept studies provide consistent support for the modifiability of facial emotion perception task performance and initial support for the modifiability of performance on Theory of Mind tasks in schizophrenia. Of course, these studies are subject to criticisms that can be leveled against most budding areas of research, including the use of very small samples and the frequent lack of appropriately matched control groups to rule out simple practice effects. In addition, the high degree of similarity between the materials used in training and those used in testing in several of the studies raise concerns about narrow "training to the task" rather than the construct of interest. Nonetheless, these studies support the feasibility and potential usefulness of more extensive training interventions.

Broad Treatment Studies

The next group of studies incorporates social cognitive training exercises in broad psychosocial treatment packages aimed at improving multiple treatment targets. Most of these studies are grounded in basic neurocognitive remediation, with additional training components designed to help generalize the benefits of improved neurocognition to different aspects of functioning and/or or psychopathology. An early example of this type of approach is Brenner's Integrated Psychological Therapy (Brenner, Roder, Hodel, Kienzle, Reed, & Lieberman, 2004), which includes specific training exercises in cognitive differentiation and social perception. Although a recent meta-analysis of 30 studies documents the positive effects of Integrated Psychological Therapy for neurocognition, psychosocial functioning, and symptoms (Roder, Mueller, Mueser, & Brenner, 2006), we are not aware of any studies that included social cognitive outcome measures. Therefore, it is unclear whether the intervention improves social cognition, or whether the

social cognitive training component contributes to the other beneficial effects of Integrated Psychological Therapy.

Several broad-based treatment packages have included social cognitive training exercises as well as formal pre- and post-training assessments of social cognition. These studies, which are summarized in Table 2, range from 22 sessions up to two years of weekly treatment. They also vary considerably in the extent to which social cognition is a focus of the intervention.

Van der Gaag and colleagues (van der Gaag, Kern, van den Bosch, & Lieberman, 2002) developed a 22-session (about 20 min per session), individually-administered remediation program that consists of four hierarchically ordered stages, including self-instruction, memory enhancement, inductive reasoning, and compensatory approaches. The inductive reasoning and compensatory approaches during the second half of the program include a series of exercises involving social perception and emotion perception, which are identified as primary treatment targets. Examples of exercises include analyzing pictures of faces and social situations to improve processing of others' thoughts and motives, learning the discrete features of basic emotional expressions, facial mimicry, practicing reading emotional sentences aloud, and role-play exercises involving different emotions. Approximately four hours were spent on these social cognitive exercises out of eight hours of total training time. Compared to controls matched for time in a leisure activities group, patients receiving the intervention showed significant differential improvements on measures of facial emotion matching and emotion labeling, though the models used in pictures for these tasks also appeared in stimuli used during the training sessions. Treatment effects for measures of attention, memory, and executive functions were generally weak.

In the context of a more intensive work therapy intervention for outpatients receiving services through the Veterans Administration, Bell and colleagues (Bell et al., 2001) evaluated whether the addition of a neurocognitive remediation intervention led to greater improvements in neurocognition, social cognition, and vocational functioning than work therapy alone. In addition to intensive individual computerized cognitive remediation exercises, the combined intervention included weekly social processing groups based on Ben-Yishay's rehabilitation model for persons with traumatic brain injury (Ben-Yishay et al., 1985). In these groups, each member gives a series of presentations based on job-related experiences and the

TABLE 2. Broad treatments

Reference and Country	Subjects and Treatment Target	Duration and Format	Treatment Description	Assessments	Results and Notes
van der Gaag et al. (2002) Netherlands	Schizophrenia inpatients 21 treatment condition 21 control condition (leisure activities) Targets: Neurocognition Social cognition	22 sessions 20-min sessions, two sessions per week for three months Individual treatment	Cognitive remediation Hierarchically ordered according to increasing cognitive complexity. (1) self-instruction, (2) memory enhancement, (3) inductive reasoning, (4) "compensatory strategies"—identifying emotions on faces and role-playing recent emotional experiences.	Pre- and posttests Emotion matching and emotion labeling tasks (developed for study). Neuropsychological test battery	Significant treatment effects found for both emotion perception tasks. No differential effects for the neuropsychological measures—some trends for memory and executive function improvements in treatment group Models in pictures used for training also appeared in the testing pictures

Bell et al. (2001) United States	Five months of treatment Individual + group treatment	Schizophrenia or schizoaffective outpatients 34 Neurocognitive Enhancement Therapy + Work Therapy 34 Work Therapy alone Targets: Vocational success Neurocognition Social cognition	<p>Neurocognitive Enhancement Training</p> <p>(1) Computerized training exercises in attention, memory, and executive function for up to five hours each week for 26 weeks, (2) Weekly social processing groups: individual oral presentations with group feedback - involves social information processing, affect regulation, and interpersonal sensitivity, (3) Biweekly feedback on cognitive assessments.</p> <p>Work Therapy: Supported Employment + Biweekly support groups with feedback on work performance and goal setting.</p>	Baseline and five-month assessments Bell Lysaker Emotion Recognition Test (BLERT; Bell et al., 1997) Theory of Mind Hinting Test (Corcoran et al., 1995) Neuropsychological test battery Four factor scores: 1. Executive function 2. Working Memory (including BLERT) 3. Thought disorder (including Hinting test) 4. Visual and Verbal recall	Neurocognitive Enhancement Therapy superior to Work Therapy alone for Factors 1 & 2, and for BLERT specifically Means for Hinting Test not presented Percentage of patients with normal BLERT scores increase from 35-60% for Neurocognitive Enhancement Therapy, compared to 47-42% for Work Therapy alone Groups not matched on hours spent in treatment
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(Continued)

TABLE 2. Continued

Reference and Country	Subjects and Treatment Target	Duration and Format	Treatment Description	Assessments	Results and Notes
Hodel et al. (2004) Switzerland	Treatment-resistant schizophrenic inpatients 11 Emotion Management Therapy 11 Problem solving Targets: Facial emotion perception Social adjustment Psychopathology	24 sessions 45-min sessions, two sessions per week for 12 weeks Group treatment	Emotion Management Therapy Addresses emotion perception and its functional consequences on social adjustment and psychopathology. Three steps: (1) Deficient emotion perception is addressed by a step-by step evaluation of one's own and others' expressions of emotions; (2) Poor social adjustment is addressed by reviewing currently used coping strategies; (3) Social adjustment and limited stress tolerance are improved by acquiring relevant and efficient coping strategies. Training incorporates behavioral interventions such as role-play or in vivo exercises.	Pre- and posttests, plus four-month follow-up assessment Facial Emotion Perception Test (Feinberg et al., 1986) Social adjustment (NOSIE-30, Honigfeld et al., 1966)	Emotion Management Therapy showed significant improvements in emotion perception test, social adjustment, and psychiatric symptoms compared to control group At the follow-up, Emotion Management Therapy effects returned to baseline for emotion perception though gains in social adjustment and symptoms continued at follow-up Subjects not randomly assigned to treatment groups.

Hogarty et al. (2004) United States	Schizophrenia and schizoaffective outpatients 67 Cognitive Enhancement Therapy 54 Enriched Supportive therapy Targets: Neurocognition Social cognition Social Adjustment	Two-year randomized trial of Cognitive Enhancement Therapy 75 hours of computerized training on attention, memory, and problem-solving exercises + 56 sessions (1.5 hours per week) of training on social cognition exercises. Group therapy	Cognitive Enhancement Therapy 1) Computer-based cognitive exercises that focus on attention, memory, and problem-solving abilities and 2) Small group training in social cognition: categorization exercises, 4) Cognitive Style formation of gistful and 5) Social Adjustment condensed messages, 6) Clinical Symptoms solving real life social dilemmas, abstraction of themes from newspaper articles, appraisal of affect and social contexts, initiating and maintaining conversations, playwriting, and center stage exercises (e.g., introducing a friend).	Baseline, 12-month, and 24-month assessments Extensive assessment battery reduced to six summary measures: 1) Social Cognition 2) Processing Speed 3) Neurocognition 4) Cognitive Style 5) Social Adjustment 6) Clinical Symptoms	12-month: Cognitive Enhancement Therapy superior for neurocognition and processing speed, and marginally superior for cognitive style, social cognition, and social adjustment. 24-month: Cognitive Enhancement Therapy superior on all composite indices except symptoms Control group not matched hours in treatment No social cognitive performance tests 12-month follow-up presented in (Hogarty et al., 2006)
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(Continued)

TABLE 2. Continued

Reference and Country	Subjects and Treatment Target	Duration and Format	Treatment Description	Assessments	Results and Notes
Eack et al. (2007) United States	Recent-onset schizophrenia and schizoaffective outpatients 18 Cognitive Enhancement Therapy 20 Enriched Supportive Therapy Targets: Neurocognition Social cognition Social functioning	12-month data from a 24-month randomized clinical trial in recent-onset patients	Cognitive Enhancement Therapy Same as above (Hogarty et al., 2004)	Baseline & 12-month assessments Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT; Mayer et al., 2003)	Cognitive Enhancement Therapy led to differential improvement in total MSCEIT scores On MSCEIT subtests, Cognitive Enhancement Therapy superior for ability to understand emotions ($d = .82$), manage emotions ($d = .83$), and use emotions to facilitate thinking ($d = .66$). Non-significant trend for ability to perceive emotions ($d = .55$)

other members are required to ask questions and give specific feedback to the presenter. In addition to basic cognitive demands, these exercises are designed to enhance social information processing, affect regulation, and interpersonal sensitivity. Participants also received separate biweekly feedback on their progress in neurocognitive training exercises and work performance. After five months of treatment, the combined intervention group showed significant differential improvement in emotion perception while no group differences were found for a Theory of Mind (hinting) task. Although the groups were not matched for total hours spent in treatment, the results suggest that an active intervention that includes general social training exercises can lead to improvement in basic emotion recognition skills (though not in more complex Theory of Mind-related skills). In addition, the nonspecific cognitive stimulation associated with working was not sufficient for the work therapy only group to achieve this improvement.

Another broad intervention is Hodel's Emotion Management Training, which was an outgrowth of the original Integrated Psychological Therapy program. This 24-session group treatment targets facial emotion perception, social adjustment, and psychopathology in three treatment phases. The first phases focuses on a step-by-step evaluation of one's own and others' expressions of emotions; the second phases addresses poor social adjustment by reviewing currently used coping strategies; and the third phase addresses social adjustment and stress tolerance limitations by acquiring new, efficient coping strategies. In a study of treatment-resistant inpatients (Hodel et al., 2004), patients were consecutively assigned to either Emotion Management Therapy or a social problem solving group control condition. Patients who received Emotion Management Therapy showed significant improvements in facial emotion perception, as well as social adjustment and general psychopathology, compared to patients in the control condition. At a four-month follow-up assessment, initial gains on the emotion perception task returned to baseline, yet gains in actual social adjustment and psychopathology somewhat surprisingly persisted. Interpretation of these findings is complicated by the lack of nonrandom assignment and the fact that the Emotional Management Therapy group had better social adjustment (within an inpatient setting) than controls at the baseline assessment. This intervention has also been employed in chronic outpatients and first episode patients (Hodel, Brenner, Merlo, & Teuber, 1998;

Hodel, Zanello, Welling, Mueller-Szer, Sandner, Wohlwend, & Wechsler, 1997).

Cognitive Enhancement Therapy (Hogarty, Flesher, Ulrich, Carter, Greenwald, Pogue-Geile, Kechavan, Cooly, DiBarry, Garrett, Parepally, Zoretich, 2004) targets neurocognition, social cognition, and social adjustment, and provides the most time intensive social cognition training of the broad interventions. Treatment begins with computer-based cognitive exercises that focus on attention, memory, and problem solving. Weekly group-based training exercises are then phased in that focus on aspects of social cognition including formation of gistful messages, solving of real-life social dilemmas, and appraisal of affect and social context. Experiential exercises designed to practice using social cognitive skills (e.g., play writing, describing a friend) are included as well. The primary social cognitive outcome variable in their initial randomized clinical trial with chronically ill outpatients consisted of summary clinician ratings of characteristics related to social cognition (e.g., self-confidence, social perception, supportiveness, tolerance, interpersonal effectiveness). The procedures were partly based on Ben-Yishay and colleague's model of rehabilitation for traumatic brain injury (1985). After 12 months of treatment, processing speed and neurocognition significantly improved in patients receiving the intervention as compared to subjects receiving supportive therapy, but the gains in social cognition for the active intervention group were at a nonsignificant trend-level. However, by 24 months of treatment, differential Cognitive Enhancement Therapy effects were found on the social cognitive composite measure as well as each of the other main summary variables, including community adjustment.

A follow-up report indicated that the improvements found in the Cognitive Enhancement Therapy group in the areas of social cognition, social adjustment, processing speed, and neurocognitive style persisted 12 months after treatment ended (Hogarty, Greenwald, & Eack, 2006). There was also evidence that processing speed, and to a lesser extent neurocognition, acted as partial mediators of the long-term effect of Cognitive Enhancement Therapy on social cognition and social adjustment. While encouraging, the groups were not matched for total hours spent in treatment. Furthermore, the social cognition outcome measures were based on ratings completed by nonblinded clinician raters who were directly involved in providing the treatment interventions,

which complicates interpretation of the apparent gains in social cognition.

A recent report by Hogarty's group (Eack, Hogarty, Greenwald, Hogarty, & Keshavan, 2007) that compared Cognitive Enhancement Therapy to enriched social supportive therapy in a new sample of early course schizophrenia patients provided further evidence for this intervention's beneficial effects on social cognition. This report presents data following the first 12 months of treatment on the Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT; Mayer, Salovey, Caruso, & Sitarenios, 2003), a well-validated, multidimensional test of emotional intelligence. Cognitive Enhancement Therapy was associated with differential improvements in overall MSCEIT scores with moderate to large effect sizes found for each of the four components of the MSCEIT, particularly the Understanding Emotions and Managing Emotions subtests. This study provides strong initial support for the effects of a broad-based treatment package on a performance measure of social cognition.

In summary, several broad treatment approaches that include social cognitive training exercises have been successfully implemented in schizophrenia. These studies demonstrated significant improvements across multiple domains of social cognition, based on clinician ratings or performance measures. However, specifically attributing pre-post differences to the social cognitive training exercises is difficult because the training in these studies was embedded within comprehensive, multicomponent rehabilitation programs. Therefore, it is not possible to disentangle these effects and evaluate the efficacy of the social cognitive treatment exercises per se.

Targeted Treatment Studies

A series of recent treatment studies have successfully employed social cognitive training, without other intervention components, to target performance on measures of social cognition. These studies, summarized in Table 3, specifically address social cognitive abilities over at least 12 training sessions.

Wölwer, Frommann and their colleagues in Germany developed the 12-session Training in Affect Recognition program to remediate facial emotion perception deficits in schizophrenia (Wölwer, Frommann, Haufmann, Piaszek, Streit, & Gerbel, 2005). The

training, which is administered to pairs of patients at a time, begins with recognition of specific facial features associated with basic emotions and gradually progresses to more complex facial displays (e.g., different intensities of emotional displays), and concludes by integrating facial displays of emotion with information relevant to real life situations, such as nonverbal gestures and understanding of social context. Training incorporates specially developed computerized facial emotion perception training exercises as well as a set of pictures of emotional faces for use in interactive exercises. An initial feasibility study demonstrated significant improvements on a 24-item facial affect perception test in 16 schizophrenia inpatients (Frommann, Streit, & Wölwer, 2003). Interpretation of this result is limited by the lack of a control condition, and complicated by the finding that symptom levels also significantly improved during the course of treatment.

In a subsequent study by this group (Wölwer et al., 2005), 77 inpatients were randomized to one of three conditions: (1) Training in Affect Recognition program; (2) A time-matched neurocognitive remediation program involving computerized and pencil-and-paper exercises in attention, memory, and executive functioning; or (3) Treatment as usual. This design enabled the investigators to assess the specificity of treatment effects. Outcome measures included the same facial emotion perception test used in the original study and a battery of neurocognitive tests of verbal learning and memory, working memory, attention, and executive functioning. Results suggested (but were not fully supportive of) a double dissociation. The Training in Affect Recognition group showed improved facial affect perception, but no improvement in verbal learning and long-term memory. In contrast, the neurocognitive remediation group showed improved verbal learning and long-term memory, but no improvement in affect perception. (The Training in Affect Recognition group also showed significant improvements in working memory compared to the treatment-as-usual group, and symptom levels appeared to improve in both active treatment conditions). This study suggests that standard neurocognitive training alone is not sufficient to improve facial emotion perception, and that improvements in facial emotion perception do not necessarily depend on improvements in basic (nonsocial) neurocognition. Since the two studies that evaluated the Training in Affect Recognition program included only a single social cognitive measure of facial emotion perception, it is unknown

TABLE 3. Targeted treatments

Reference and Country	Subjects and Treatment Target	Duration and Format	Treatment Description	Assessments	Results and Notes
Frommann et al. (2003) Germany	Schizophrenia inpatients 16 "post-acute" patients Target: Facial affect perception	12 sessions 45 minutes per session, two sessions per week for six weeks Small groups of two patients with one therapist	Training in Affect Recognition Remediation of facial affect recognition in roughly three blocks of four sessions each: (1) Learning to gradually identify and discriminate the prototypical facial signs of the six basic emotions as well as to use verbalization and self-instruction as alternative strategies to analyze facial affect step by step; (2) reintegration of this piecemeal approach to facial affect into an increasingly holistic processing mode with fast decisions, relying on first impression, nonverbal processing, and processing of facial expression with small intensities; (3) processing of nonprototypical, ambiguous expression of affect often occurring in everyday life and the integration of facial expression into the social, behavioral, and situational context. Includes computerized training exercises, and exercises with pictures of faces and social scenes.	Pre- & Post-treatment 24-item facial emotion labeling task (Ekman and Friesen, 1976)	Significant improvement on facial emotion labeling task Patients significantly improved in symptom levels

(Continued)

TABLE 3. Continued

Reference and Country	Subjects and Treatment Target	Duration and Format	Treatment Description	Assessments	Results and Notes
Roncone et al. (2004) Italy	Schizophrenia inpatients at day hospital Ten Metacognitive Intervention Program Ten Antipsychotic meds and supportive therapy as needed Targets: Theory of mind Social intelligence Emotion perception	22 sessions one session per week, sessions lasted up to one hour Group treatment with ten patients and five therapists	Metacognitive Intervention Program Based on "mediated learning" Instrumental Enrichment Program (Feuerstein, 1980); six learning objectives: (1) acquisition of awareness of deficits reported in cognitive behavior; (2) acquisition of concepts about difficulty in expression recognition; (3) formation of new learning habits in social competencies; (4) comprehension of the nature and usefulness of cognitive processes involved in social interactions; (5) creation of a motivation intrinsic to the task; (6) modification of self and other people's perception. Exercises include presentation of group topics by leader, and practical exercises to assist patients to overcome their specific deficits.	Pre- and posttreatment Theory of Mind: first and second order false belief stories (Baron-Cohen, 1989; Happé, 1994) Perceptual recognition of emotions: Cartoon drawings representing schematic faces, human faces and cartoon characters (sadness, fear, anger, happiness) (Hoschel & Irle, 2001) Mach IV Scale of "Machiavellian Intelligence" (Byrne & Whiten, 1988) Neuropsychological test battery Social adaptation measured by Disability Assessment Schedule (Morosini et al., 1988)	Active treatment group showed significant improvements in first and second order Theory of Mind, emotion recognition (for all four emotions), Mach IV scale, social adaptation, and negative symptoms No intervention-specific changes on neurocognitive tests, with both showing improved verbal fluency

Wölwer et al. (2005) Germany	Schizophrenia— mixed inpatients and outpatients 28 Training in Affect Recognition 24 Cognitive Remediation 25 Treatment as usual Target: Facial affect perception	12 sessions 45 minutes per session, two sessions per week for six weeks Small groups of two patients with one therapist	Training in Affect Recognition Same as above (Frommann et al., 2003) Cognitive remediation: computerized training exercises in attention, memory, and executive functions, plus verbalization and self- instruction exercises.	Pre- & post-treatment 24-item facial emotion labeling task (Ekman & Friesen, 1976) Neuropsychological test battery	Training in Affect Recognition showed differential improvements in facial emotion labeling and working memory, but not other neuropsychological tests Cognitive Remediation group showed differential improvement in verbal learning and memory only, but not in facial emotion labeling or other neuropsychological tests Moderate improvements in symptoms across groups
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(Continued)

TABLE 3. Continued

Reference and Country	Subjects and Treatment Target	Duration and Format	Treatment Description	Assessments	Results and Notes
Penn et al. (2005) United States	Psychiatric inpatients Seven patients (six with psychotic spectrum disorders) Targets: Facial emotion perception, Theory of mind Social cognitive bias (persecutory/ hostility)	18 sessions 60-minute sessions modified for inpatient schedule Group treatment	Social Cognition and Interaction Training Three phases: (1) Understanding emotions (six sessions): defining emotions, linking to facial expressions (defining emotions, emotion mimicry training, understanding paranoia); (2) Social cognitive biases (seven sessions): figuring out situations, distinguishing facts from guesses, avoiding jumping to conclusions by examining the evidence, understanding bad events; and (3) Integration (five sessions): application to daily life and practice, checking out guesses in real life. Exercises include didactic group discussions, interactive group activities.	Pre- and posttreatment Face Emotion Identification Task (Kerr and Neale, 1993) Theory of Mind Hinting Task (Corcoran, 2001) Ambiguous Intentions Hostility Questionnaire Hostility Questionnaire (Combs et al., 2007b)	Significant improvement on Hinting Task Trend toward improvement on one Ambiguous Intentions Hostility Questionnaire subscale No significant changes on emotion identification task Moderate improvements in symptoms across study period

Choi & Kwon (2006) Korea	Schizophrenia and schizoaffective outpatients 17: Social Cognitive Enhancement Training + standard psychiatric rehabilitation 17: Standard psychiatric rehabilitation only Target: Social perception	36 sessions 90-minute sessions spaced over six months Group treatment	Social Cognition Enhancement Training By utilizing four-column cartoons, the intervention was conducted in a semi-structured, psychoeducational learning environment. After a group activity to engage patients in the training, each participant was encouraged to participate actively in social cognitive exercises, in which he/she was trained to perceive social cues in the cartoon, arrange four pieces of a cartoon in the right order based on contextual information, and explain coherently the social situation depicted in the cartoon. Also provided an opportunity to discuss how to solve problems in a social situation similar to that depicted in the cartoon.	Pre-, two-month, four-month, and posttreatment (six-month) assessments Picture Arrangement Test (Park, 1991) Social Behavior Sequencing Task (Kwon et al., 2003) Emotion Recognition Test (Lee, 2001): items are pictorial, including faces and cartoon scenes that portray emotions.	Social Cognition Enhancement Training showed differential improvements on Picture Arrangement Test at four-month and post-test assessments, and Sequencing Test at two-month assessment. No additional significant treatment effects. Groups not matched on hours spent in training Drop out rates: 41% in treatment group, 53% in control group
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TABLE 3. Continued

Reference and Country	Subjects and Treatment Target	Duration and Format	Treatment Description	Assessments	Results and Notes
Combs et al. (2007a) United States	Forensic inpatients with schizophrenia spectrum disorders 18 Social Cognition and Interaction Training Ten coping skills as part of treatment as usual Targets: Facial emotion perception Theory of mind Social cognitive bias (persecutory / hostility)	18 sessions 60-minute sessions, one session per week over 18 weeks Group treatment	Social Cognition & Interaction Training Same as above (Penn et al., 2005) Control condition: Symptom management, problem-solving, and relapse prevention skills served as the comparison condition (this was part of routine treatment, not an additional treatment).	Pre- and posttreatment Face Emotion Identification Test and Face Emotion Discrimination Test (Kerr & Neale, 1993) Social Perception Scale (Garcia et al., 2003) Theory of Mind Hinting Task (Corcoran et al., 1995) Ambiguous Intentions Attributional Questionnaire (Combs et al., 2007b) Need for Closure Scale (Webster and Kruglanski, 1994) Social Functioning Scale (Birchwood et al., 1990) and number of aggressive incidents on unit	Social Cognition and Interaction Training showed differential improvements on all social cognitive tests, reported better social size and quality of social networks, and exhibited fewer aggressive behaviors on the ward. All effect sizes were moderate to large Patients not randomly assigned to treatment conditions

whether this resource-intensive intervention leads to improvements in other social cognitive processes.

An Italian group used a very different training approach to improve social cognition in schizophrenia inpatients (Roncone R., Mazza, M., Frangov, I., De Risio, A., Ussorio, D., Tozzini, C., Casacchia, M., 2004). In this study, a metacognitive learning strategy originally developed for people with learning disabilities was used to help participants develop skills in the areas of Theory of Mind, social intelligence, and emotion perception. This 22-session group-based program involves the use of exercises and teaching based on "mediated learning." The group leader or mediator helps patients modify their erroneous beliefs and thinking strategies for the purpose of, "helping the subject's capacity to mentally anticipate actions, so that he or she can provide a flexible answer to a new event and focus attention not on the learning products, but on the process established in learning." The program aims to "change subjects' cognitive structure by transforming their passive and dependent cognitive style into an autonomous one." A cohort of ten inpatients randomly assigned to receive this intervention showed improvements on measures of Theory of Mind (false belief tasks), social intelligence, and emotion perception as compared to ten inpatients in treatment as usual. The treated patients also showed greater improvements than controls on some of the executive functioning tasks and on global measures of negative symptoms and social disability, though these findings must be interpreted in light of the fact that the groups were not matched for hours spent in structured treatment.

Penn and colleagues in the United States developed another targeted treatment, Social Cognitive and Interaction Training (Penn, Roberts, Combs, & Sterne, 2007). This is a three-phase, 18-session intervention that addresses emotion perception, attributional bias, and Theory of Mind. The intervention is designed for small groups of six to eight patients. Phase one focuses on defining basic emotions and linking them to facial expressions through the use of a commercially available software program. The second phase focuses on identifying and modifying interpersonal attributions (e.g., avoiding "jumping to conclusions" and making hostile attributions based on insufficient evidence) and improving theory of mind skills (e.g., distinguishing "facts" about social contexts from "guesses" about what others are thinking and feeling). The final phase involves integrating and generalizing these skills by applying

them to increasingly realistic social situations. The authors developed a set of still photos and video clips of social interactions as well as a series of innovative training exercises, such as playing a modified version of "20 questions" to analyze social situations.

An initial feasibility study examined Social Cognition and Interaction Training in seven inpatients with psychotic disorders (Penn, Roberts, Munt, Silverstein, Jones, & Sheitman, 2005). Significant improvements were found on a social attribution measure developed by this group (Combs, Penn, Wicher, & Waldheter, 2007b) and on a Theory of Mind (hinting) task. Clinical symptoms also improved during the treatment interval. However, no improvements were found for facial emotion perception.

In a subsequent study by this group (Combs, Adams, Penn, Roberts, Tiegreen, & Stem, 2007a), forensic inpatients with psychotic disorders completed either Social Cognition and Interaction Training or Coping skills training sessions that were part of the treatment facility's regular program. The Social Cognition and Interaction Training intervention was slightly modified to include more training in the area of facial emotion perception. Compared to the skills training group, the Social Cognition and Interaction Training group showed significant improvements in social attribution and Theory of Mind, as well as facial emotion perception. Effect sizes were moderate to large. In addition, Social Cognition and Interaction Training participants reported greater improvements in their ability to interact with others and the size and quality of their social network on the treatment ward than controls, and showed greater reductions in aggressive incidents than controls, supporting the functional relevance of this intervention (within an inpatient setting).

Finally, the Social Cognition Enhancement Training developed in Korea identifies social context appraisal and perspective taking as the primary treatment targets (Choi & Kwon, 2006). Four-column cartoons are employed as the major training material in exercises that encourage participants to perceive social cues in each panel of the cartoon, arrange the panels in order based on contextual information, and provide coherent explanations of the social situations depicted in the cartoons. The cartoons become increasingly complex across 36 group-based training exercises. Compared to outpatients receiving standard psychiatric treatment, patients who received standard treatment plus the Social Cognition Enhancement Training intervention improved on a picture arrangement

subtest from an Intelligence Scale developed for children, but generally showed no improvements on specialized measures of social behavior sequencing or emotion recognition. These findings may discourage exclusive reliance on cartoon-based training exercises. However, interpretation is complicated by the unusually high drop-out rates in the treatment (41%) and control (53%) groups.

In summary, initial studies of targeted treatments provide generally strong support for their ability to improve performance on social cognitive tests. The various training approaches employed in these studies were apparently well-tolerated, with patients reporting favorable impressions (e.g., Penn et al., 2007; Roncone et al., 2004) and demonstrating generally low attrition rates (but see Choi & Kwon, 2006). There were also suggestive findings from two studies that patients showed improvements in aspects of adaptive functioning (Combs et al., 2007a; Roncone et al., 2004). An integration of findings across studies is made somewhat difficult by the substantial heterogeneity in training methods, training stimuli, and outcome measures. In addition, these encouraging findings must be interpreted in the context of many important methodological limitations, including the generally small sample sizes, the frequent lack of control groups matched for hours spent in treatment, potential biases associated with quasiexperimental designs, and the absence of follow-up assessments to evaluate the durability of improvements after the conclusion of treatment. It should also be noted that studies of the Training in Affect Recognition program developed by Wölwer and colleagues and the Social Cognition and Interaction Training program developed by Penn and colleagues have only been conducted with inpatients. Because social cognitive interventions will most likely benefit patients who are living in the community, it will be critical to demonstrate their efficacy in community-dwelling outpatients. We are aware of several on-going studies that are evaluating the Social Cognitive and Interaction Training intervention in outpatient settings, including an NIMH-supported randomized controlled trial by Penn and his colleagues.

CONCLUSIONS

The rapidly growing evidence that social cognitive deficits are key, unique determinants of poor community functioning in

schizophrenia provides a strong rationale for intervention at the level of social cognition. Although psychosocial treatment of social cognitive deficits in schizophrenia is currently in its infancy, the initial efficacy results are encouraging. Research from groups in several countries suggests that: (1) performance on social cognitive tests is amenable to commonly used intervention techniques, (2) longer-term broad interventions that include social cognitive training exercises appear to be well-tolerated by patients and beneficial for certain aspects of social cognition, and (3) longer-term targeted treatments can lead to improvements across multiple domains of social cognition. Thus, continued development of interventions for social cognitive deficits appears to be worth pursuing. As research in this area continues to progress, the field will need to deal with several issues and challenges related to the content, process, and instrumentation of social cognitive interventions, as well as the interface between social and non-social cognition.

To date, most of the social cognitive treatment research has focused on facial emotion perception. This is a logical starting point, since emotion perception is the most extensively studied and understood aspect of social cognition in schizophrenia. In addition, training in facial emotion perception is amenable to highly structured, skills training approaches that have a long history of use in schizophrenia treatment research. However, a sole focus on this narrow aspect of social cognition is unlikely to lead to optimal treatment outcomes; navigating the complexities of social interactions requires much more than an appreciation of prototypical facial expressions detached from an interpersonal context.

Other aspects of social cognition are more challenging treatment targets. In part, this reflects a lack of consensus among schizophrenia researchers about how to define other key components of social cognition (Green et al., 2005). For example, the term Theory of Mind has been used by schizophrenia researchers to refer to a variety of mentalizing processes (Brüne, 2005). Concepts included in this domain, such as appreciation of humor, sarcasm, or deception, are difficult to concisely define and translate into training exercises. In the domain of social perception, concepts such as perceiving nonverbal gestures and understanding implicit social norms can also be quite challenging to define and convey in the context of a training program. Other social cognitive processes, such as perception of emotional vocal quality or prosody, continue

to be actively researched and clarified even by basic behavioral scientists (e.g., Scherer, 2003; Wichmann & Blakemore, 2006). As researchers make progress in more precisely defining and assessing these complex social cognitive processes, interventions can hone in on them.

A few research groups have started to address these challenges through the use of innovative training techniques, with initially promising results found for aspects of Theory of Mind and attributional style (Kayser et al., 2006; Penn et al., 2005; Roncone et al., 2004) also see (Moritz & Woodward, 2007). Our group recently completed a small, controlled feasibility study of a group-based social cognitive intervention in schizophrenia outpatients that incorporated emotion perception and attributional bias exercises from the Training in Affect Recognition program (Wölwer et al., 2005), the Social Cognitive and Interaction Training program (Penn et al., 2007), and other sources, as well as new exercises aimed at addressing social perception and Theory of Mind (Horan et al., submitted). For example, in line with procedures developed by Penn and colleagues, patients are trained to develop skills as a "social detective" and to identify "mismatches" between the clues they detect in a social situation (e.g., voice tone, the literal meaning of a what a person says, and contextual factors) that may reflect sarcasm or deception. Skills are developed through guided evaluation of videotaped vignettes that depict people interacting in different social contexts.

Future treatments may also benefit from targeting aspects of social cognition that have received minimal attention in schizophrenia research. For example, empathy is regarded as a foundational social cognitive ability (Decety & Jackson, 2006; Iacoboni & Dapretto, 2006), but has received very limited research attention in schizophrenia. In addition, automatic or implicit aspects of social cognition have been relatively unexplored in schizophrenia, yet these processes may be quite important as many aspects of adaptive social functioning appear to be acquired and enacted implicitly (Bargh & Williams, 2006; Lieberman, 2000).

It will also be important to determine which learning principles are most effective for training patients to improve their social cognitive skills. A range of approaches have already shown promise in the studies reviewed above, including verbalization, repetition, metacognitive strategies, computerized training exercises, group problem-solving activities, guided group discussion of social

material (e.g., films, photos, vignettes, cartoons), guided group discussion of actual social experiences, facial mimicry, role play exercises, didactic exercises, and group-based cognitive behavioral therapy approaches (e.g., avoiding jumping to conclusions). Along these lines, it remains to be determined whether homework assignments contribute to the benefits of the interventions reviewed above, as the role of homework varied considerably.

Another consideration for future research is the social cognitive assessment instruments that are currently available for use in clinical trials. The majority of the social cognitive measures used in schizophrenia research were not developed for use in clinical trials and their sensitivity to change in the context of treatment trials is unclear. In addition, the psychometric properties of several social cognitive measures are often less than ideal. For example, tasks of facial affect perception, social cue perception, and relatively simple first order and second-order Theory of Mind tasks have sometimes been found to show ceiling effects in schizophrenia, particularly among higher functioning patients (e.g., Subotnik, Roncone, Mazza, Frangou, De Risio, Ussorio, Tozzini, Casaccia, 2006). Furthermore, instrumentation in the area of attributional bias is currently very limited, though method developments currently underway (Combs et al., 2007b) may be useful in this regard. As the field progresses, it will be useful to develop new, developmentally-appropriate performance measures that capture the range of impairments found in people with schizophrenia and that are amenable to use in clinical trials.

A final open question concerns the relationship between basic neurocognition and social cognition. It is not clear whether improvements in basic neurocognition are prerequisite "building blocks" for improvements in social cognition. For example, in a broad treatment study, Hogarty and colleagues (Hogarty, Greenwald, & Eak, 2006) found that the effects of CET on social cognitive measures were mediated by improvements in more basic neurocognitive processes (particularly processing speed). However, the targeted treatments reviewed above found improvements in social cognition training without cooccurring training in basic neurocognition. In fact, the study by Wölwer and colleagues (Wölwer et al., 2005) suggested that improvements in basic neurocognition and social cognition (facial emotion perception) followed relatively distinct trajectories. It remains to be determined whether social cognitive interventions can be used as efficient "stand alone"

treatments, or whether there is a synergistic effect in holistic treatment packages that also include pharmacological and/or psychosocial interventions to enhance basic neurocognition.

The ultimate goal of social cognitive interventions is to enable people with schizophrenia to achieve lasting improvements in functional outcome. Fulfillment of this goal will require a great deal of additional work. We believe the emerging research in this area represents an exciting new approach to helping patients achieve a recovery that goes beyond the traditional focus on symptom management to include more effective and satisfying social functioning in daily life.

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